**Content Area:** Biology

**Grade level:** 8th

**Unit**: Cell Processes   
  
**Lesson Title**: Biotechnology

**Estimated Length:**﻿ 3 days

**Sunshine State Standards**:

**Benchmarks**:

SC.7.L.16.4 Students will be able to recognize and explore the impact of biotechnology (cloning, genetic engineering, and artificial selection) on the individual, society, and environment.

LA.8.1.6.1 Students will use new vocabulary that is introduced and taught directly.

**National Science Education Standards**

Understanding about Science and Technology

Science and Technology in Society

**Rational:**

With new technology coming out on a daily basis it is important to understand the risks and benefits of biotechnology.

**Objective:**

* The students will be able to identify different forms of biomass and its uses.
* Students will also be able to biotechnology in terms of genetically modified crops.

**Content Outline:**

1. Plant Biotechnology
   1. When used in terms of plants, biotechnology usually means to take a desired trait from one plant (wild) and moving it to another plant (domestic).
      * 1. *Biotechnology – the process of moving DNA directly from one organism to another.*
2. Genetically Modified Crops (GM Crops)
   1. “Golden Rice” is an example of a GM Crop.
   2. This rice grain contains two daffodil genes (giving it the yellow color) which helps the rice produces beta-carotene it would normally not be able to do.
      * 1. *Genetically Modified Crops – crops in which desired DNA from one kind of organism 9usually a different species) has been inserted into the crop to improve it.*
3. The GM Tomato
   1. Improvements made to this crop include:
      1. DNA from cotton plants that are no longer sensitive to herbicides.
      2. DNA from insect-resistant tobacco plants
      3. DNA from other tomato plants whose fruit does not spoil quickly.
4. How GM Crops are Made
   1. The easiest way is through a virus or bacterium with the desired DNA. The virus or bacterium infects the plant cell and the DNA is transferred, making them genetically modified.
   2. The other method, first used in 1987, coats small metal particles with the desired DNA and shoots them into the plant cell.
5. Biomass
   1. Biomass can be found in all three phases: solid, liquid (gasohol), and gas (biogas). Solid biomass is what a large portion of the world uses for energy today.
      * 1. *Biomass – organic material from plants and/or animals that used for energy (i.e. wood, coal).*
6. Gasohol
   1. While alcohol production from biomass is economical it is not energy efficient. Large amounts of energy are required to grow and harvest the crops. Then much of the original energy in the biomass is lost in the conversion to alcohol.
      * 1. *Gasohol – a mixture of gasoline and ethanol.*
        2. *Alcoholic Fermentation – the process when microorganisms convert sugar from sugar cane, corn, and grain into ethanol.*
7. Biogas
   1. In china, biogas digesters use microorganisms to decompose household and agricultural wastes to produce biogas that is used for heating and cooking. The solid remains are removed and used as fertilizer.
      * 1. *Biogas – a mixture of gases that can be stored and transported like natural gas. When burned it produces fewer pollutants than coal or biomass.*
8. Improving the Efficiency of Farming
   1. With the help of satellite images computers, which will be an essential tool like the tractor, allow farmers to practice “precision farming.”
      * 1. *Precision Farming – knowing exactly how much water and fertilizer different fields require to produce the maximum yield.*
   2. It saves time and money, increases crop yields, and reduces nutrient run-off.

**Procedure:**

Day 1:

* Bell work: In your Science Journal draw and label the components to the Carbon Cycle. (5 min)
* Go over bell work (5 min)
* Hand out guided notes (1 min)
* Lecture (20 – 30 min)
  + Students are to actively listen and fill in guided notes during the lecture.
* Crossword Puzzle (10 – 20 min)
  + Students can use their guided notes to help their figure out the clues to answer the crossword puzzle.

Day 2:

* Bell work: What are the risks to GM Crops? What are the benefits? Create a Comparison Table in your Science Journal to answer the questions. (5 min)
* Go over bell work (5 min)
* Hand out review sheet. (1 min)
* Review for Post-Test (30 – 40 min)
  + After filling in the review sheet the class is encouraged to ask any questions about the topics they are still struggling with or need more clarification.

Day 3:

* Prep-time (5 min)
  + Students need to sharpen pencils and put all papers, folders, and books away.
* Pre-test (30 – 40 min)
* After the test
  + Students are encouraged to review their answers if they finish early, otherwise they can read silently.
  + Students are to hand in Guided Notes, Crossword Puzzle, and Review Sheet.

**Materials:**

The materials needed for this section of the unit are a Projector for Power Point Slides and Bell Work Prompts, Guided Notes, Crossword Puzzle, Review Sheet, and Post-Test.

**Assessment:**

* Students will be assessed in several ways
  + Bell work will be turned in at the end of the unit to check for participation.
  + Guided notes, Crossword Puzzle, and Review Sheet will be turn in after the Test to be checked for completion and accuracy.

**Resources:**

* Jenner, Ph.D., J. (Ed.). (2000). *Science Explorer: From Bacteria to Plants*. Upper Saddle River, NJ: Prentice Hall.
* Biggs, A., Daniel, L., & Ortleb, E. (Ed.). (1999). *Life Science*. New York, NY: Glencoe/McGraw-Hill.
* Campbell, N., & Reece, J. (Ed.). (2008). *Biology*. San Francisco, CA: Pearson/Benjamin Cummings.